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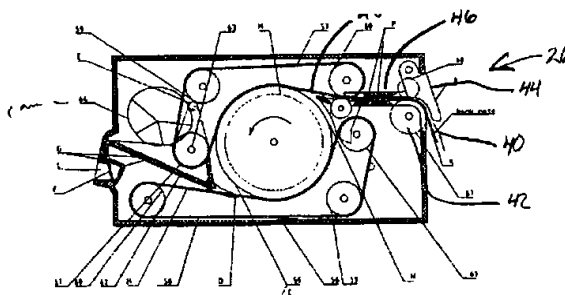
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(54) **BANKNOTE STACKER AND DISPENSER**

(57)

The validator and dispensing unit advantageously receives and aligns banknotes which are to be dispensed from the unit. Received banknotes are stacked on above the other and dispensed as a stack. The unit in a first mode receives banknotes individually and forms a stack of received banknotes and in a second mode dispenses the stacked banknotes as a group.



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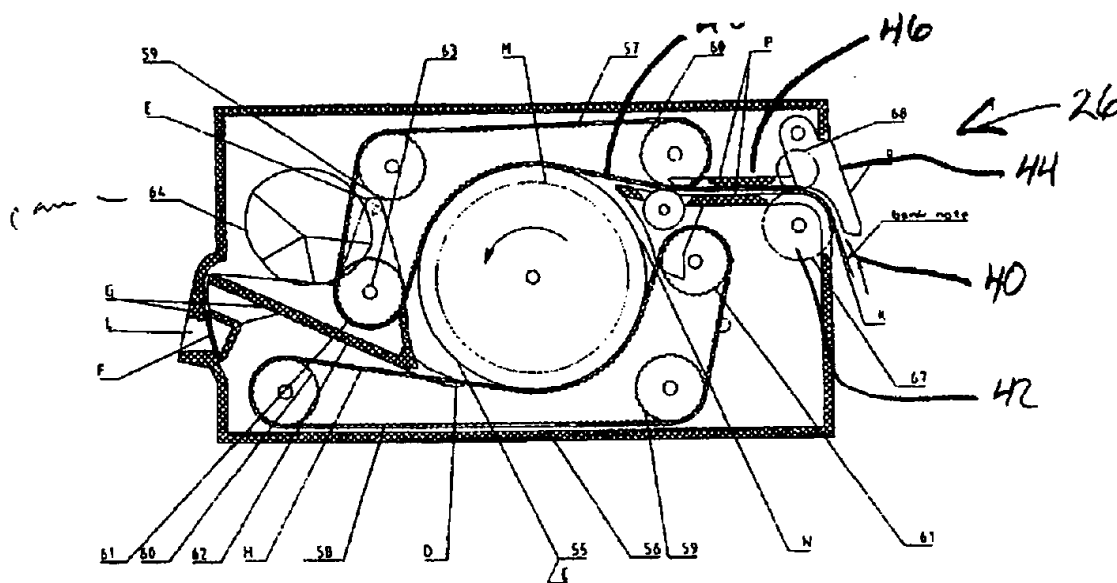
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(57) Abrégé/Abstract:

The validator and dispensing unit advantageously receives and aligns banknotes which are to be dispensed from the unit. Received banknotes are stacked on above the other and dispensed as a stack. The unit in a first mode receives banknotes individually and forms a stack of received banknotes and in a second mode dispenses the stacked banknotes as a group.

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ABSTRACT OF THE DISCLOSURE

The validator and dispensing unit advantageously receives and aligns banknotes which are to be dispensed from the unit. Received banknotes are stacked on above the other and dispensed as a stack. The unit in a first mode receives banknotes individually and forms a stack of received banknotes and in a second mode dispenses the stacked banknotes as a group.

TITLE: BANKNOTE STACKER AND DISPENSERBACKGROUND OF THE INVENTION

5

The present invention relates to devices for accepting of banknotes and accumulating banknotes in a particular manner and dispensing a stack of banknotes.

10

Banknote validators receive banknotes and conduct an assessment of each banknotes prior to making a decision whether the banknote should be accepted or rejected. If the banknote is accepted it is normally fed to a storage cassette which is removed by the owner from time to time.

15

Some banknote validators include a storage arrangement for storing of banknotes for subsequent dispensing as part of the transaction with a user. The banknotes are typically wound on a drum with belts positioned to separate each banknote. With this storage arrangement banknotes are wound on in one direction and dispensed in an opposite direction such that the last wound banknote is dispensed first. Such devices typically forward each banknote to a hopper type arrangement where the user then removes the dispensed banknotes.

20

It would be more desirable to dispense a stack of banknotes in a single action as opposed to dispensing banknotes individually for accumulation in a hopper or other type device.

25

The present invention provides a device which is used with a validator and banknote storage arrangement for receiving banknotes individually and stacking the banknotes one atop the other and thereafter dispense a stack of banknotes.

30

SUMMARY OF THE INVENTION

A device according to the present invention receives and stacks banknotes and dispenses stacked banknotes together. The device includes a rotary accumulator of a size such that the banknotes to be dispensed can only be partially wrapped about the periphery of the accumulator. The device includes a first drive belt and a second drive belt with each drive belt in contact with a limited portion of the accumulator to define a banknote entrance in a gap between the drive belts and a bank discharge slot in a gap between the drive belts. The accumulator is driven by the belts and the banknotes are located between the drive belts and the accumulator. A control arrangement controls the feed of banknotes about to be individually partially trained about the accumulator to stack banknotes on the accumulator one atop the other and in a manner to define a gap between the leading and trailing ends of the stack of banknotes. The control arrangement includes a gate member associated with the discharge slot and movable into the gap between the leading and trailing ends of the banknotes for stripping thereof from the accumulator and discharging the stacked banknotes through the discharge slot.

According to an aspect of the invention at least one of the drive belts drives the stacked banknotes through the discharge slot.

According to a further aspect of the invention the accumulator is driven in one rotational direction by the drive belts for accumulating stacked banknotes and the accumulator is driven in a second rotational direction for discharging the stacked banknotes.

According to yet a further aspect of the invention drive belts are located on opposite sides of the accumulator.

According to yet a further aspect of the invention the drive belts are each driven at the same speed and the control arrangement coordinates the speed with a feed speed of a banknote about to be stacked on the
5 accumulator.

According to yet a further aspect of the invention the control arrangement compares a signal from a separate drive feeding a banknote about to be stacked on
10 said accumulator with a stack signal from the device. The feed signal includes information to the position of the feed banknote held up to the device and the stacked signal includes information with respect to the position of any banknotes stacked on the accumulator. The control
15 arrangement then adjusts the speed of the stacked banknotes relative to the speed of the feed banknote such that the feed banknote merges in an aligned manner with the stacked banknotes already located on the accumulator.

20 According to yet a further aspect of the invention the accumulator is freely rotatable and is driven in response to the first and second drive belts.

25 BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are shown in the drawings wherein:

Figure 1 is a perspective view of a combine validator and dispenser unit;

30 Figure 2 and 3 are a vertical and a side view of the combined validator and dispenser unit including the device for stacking of the banknotes to be dispensed;

Figures 4, 5, and 6 are top views of the stacking and dispensing device illustrating the stacking of
35 banknotes on the accumulator and the subsequent dispensing of stacked banknotes;

Figure 7 and figure 8 show an alternate dispenser unit having only one drive belt cooperating with the accumulator.

5

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 illustrates a combined validator and dispenser unit 2 which processes banknotes 4 and interacts with a smart card 6. As with traditional validators the banknotes are fed through the banknote slot 8 for evaluation and processing. The smart card 6 is fed into the smart card slot 10 if the transaction is to be associated with the smart card. The combined unit 2 accumulates accepted banknotes in the banknote cassette 11 and also temporarily stores banknotes for later dispensing in accumulators 28 and 30 (fig. 2 and 3). If a received banknote is evaluated by the validator 22 and determined to be of questionably authenticity it is returned through the banknote slot 8.

20

The combined validator and dispenser unit 20 of figures 2 and 3 evaluates banknotes in a conventional manner, however, received banknotes can optionally be temporarily accumulated in first and second bill accumulators 28 and 30. In some cases received banknotes are fed directly to the storage cassette 32. A transport feed drive 24 receives a banknote which has been processed by the evaluation head 22 and transports the banknote to the accumulators or to the storage cassette. This drive is reversible for transporting banknotes from the accumulators to the stacking and dispensing unit 26. In the design shown in figures 2 and 3, each of the bill accumulators 28 and 30 include their own drive arrangements and electronic controls. Furthermore the accumulators can be separately removable from the validator should service be required.

30

35

The accumulators 28 and 30 are designed to store received banknotes in a series manner such that the

trailing edge of one banknote is closely adjacent the leading edge of the next received banknote. Thin belts are wound with banknotes to separate each banknote and allow the accumulator to output one banknote at a time. With
5 these devices the last banknote received is the first banknote outputted.

With the validator and dispensing unit of figures 2 and 3 it may be desirable to dispense a certain number of
10 banknotes which have been previously stored on one of the accumulators 28 and 30. Normally one of these accumulators stores one denomination of a particular currency and a second accumulator stores a different denomination. For example, accumulator 28 may store \$5 notes and accumulator
15 store \$10 notes. In some activities of the validator it may be desirable merely to store on a temporary basis a series of banknotes which have been inputted to the device for a possible transaction. If the transaction is voided for any particular reason the same banknotes can be
20 returned by outputting the banknotes from the particular accumulator and providing these banknotes to the stacking and dispensing device 26. In this way the same banknotes that are received by the combined unit are returned to the user.

25
A further consideration of the banknote validator and dispensing device of figures 2 and 3 is efficient processing time such that the validator is convenient to use. It is important to have an efficient transaction time
30 with respect to processing of received banknotes.

It has been found that the user is more willing to use the device if the transaction time is relatively fast. With the combined validator and dispenser unit of
35 figures 2 and 3 banknotes can be quickly processed and stored on one of the accumulators with knowledge of the particular denominations which have been stored. After the transaction is complete the device can appropriately

redirect any of the banknotes as necessary. For this type of operation it is often desirable to have yet a further accumulator which can be used for the temporary storage of banknotes to be appropriately processed during any idle
5 time of the validator.

The stacking and dispensing device 26 receives banknotes through the feed slot 40 and stacks the received banknotes on the accumulator 56. The accumulator 56 is
10 preferably cylindrical and has a series of slots along in the surface thereof. This defines an outer peripheral surface 58 and an inner peripheral surface 60. The banknotes are stacked against the outer peripheral surface 58 as shown in figure 5. The accumulator 56 is driven by a
15 first drive belt 48 which engages only a portion of the accumulator and a second drive belt 50. The first and second drive belts contact the outer most banknote and the stacked banknotes effectively drive the accumulator 56.

20 The accumulator 56 is responsive to the speed of the drive belts. With this arrangement the rotational speed of the accumulator varies relative to the speed of the drive belt and the tangential speed of the last banknote is equal to the linear speed of the drive belts.
25 The banknotes are stacked one atop the other with the leading edges 73 of the stack of banknotes 72 aligned and in this case the trailing edges 75 of the banknotes are also aligned as the banknotes are of a common length. This length is less than the periphery of the accumulator 56
30 such that there is a substantial gap 80 between the leading edges 73 and the trailing edges 75 of the stacked banknotes.

The feed banknote 74 of figure 5 is about to
35 enter the stacking and dispensing device 26 as the toggle member 44 has been moved outwardly to guide the leading edge of the feed banknote 74 into the feed channel 46 of the device. The transport feed drive 24 which is typically

a belt drive or rollers causes the banknote 74 to move. The speed of this transport is coordinated with the variable speed of the drive belts such that the leading edge of the feed banknote aligns with the leading edges 73 of the stacked banknotes 72. Various arrangements including sensors and processing electronics can be used to achieve the necessary synchronization between the drive speeds. Banknotes stored on the accumulators 28 and 30 are individually fed to the stacking and dispensing device 26 for initial stacking one atop the other as shown in figure 5. In this way a stack of banknotes is accumulated on the accumulator 56. The accumulator 56 is continuously driven by the belts and the belt speed is synchronized with the speed of the transport 24 to achieve the necessary alignment of banknotes. This continuous type of motion of the accumulator, although not constant motion allows fast processing relative to a stop/start motion for accumulation of banknotes used in prior art devices.

Once the desired number of banknotes are partially trained about accumulator 58, a discharge toggle 64 is moved to the position of figure 6. It can be seen that the fingers 66 of the discharge toggle are received in the slots of the accumulator and as such provide a transition from the accumulator to the discharge port 68.

Once the desired number of banknotes have been stacked on the accumulator the direction of the accumulator is reversed and the toggle 64 is moved to the position of figure 6. The fingers 66 are located in the gap 80 and the rotational direction of the accumulator is reversed. The second drive belt 50 continues to partially engage the stacked banknotes 62 and the stacked banknotes are stripped from the accumulator and dispensed as a group through the discharge port 68. The second drive belt extends beyond the accumulator 56 to drive the stacked banknotes through the port 68. With this arrangement the trailing edges of the banknotes are dispensed first.

The stacking and dispensing device 26 is rotated in one direction for accumulation of banknotes and in a second direction for dispensing of banknotes. As can be appreciated from a review of figures 5 and 6 any attempt to force the discharge toggle 64 to a dispensing position in an attempt to withdraw bills fraudulently will have little effect as the accumulator is rotating in a counterclockwise direction and the stacked banknotes easily move past the toggle. If desired the fingers 66 can be of a resilient material and are easily cammed outwardly such that the stacked banknotes to continue their movement. Therefore the position of the toggle 68 does not determine whether the banknotes will be dispensed. It is the position of the toggle in combination with the direction of rotation of the accumulator that determines whether stacked banknotes will be discharged.

In the arrangement shown in figures 4 through 6 a mechanical cam 81 is controlled and determines the position of the discharge toggle 64. Other arrangements are possible however a strong mechanical position control is preferred such that movement of the discharge toggle by engaging the blocking member 83 is strongly opposed.

The stacking and dispensing device of figures 4 through 6 coordinates with the drive transport 24 of the overall device to achieve stacking of the banknotes one atop the other. The partial training of the banknotes about the periphery of the accumulator provides a gap where the surface of the accumulator is exposed and this gap is advantageously used to engage the accumulator at a point beneath the stacked banknotes to assure full dispensing of any stacked notes through the discharge port when the device is operated in a discharge mode.

The operation of the device has been described with respect to banknotes of a certain length all of which are

equal, however this need not be the case. The accumulator is sized to receive the longest banknote with the banknote only partially wrapped about the accumulator. However, this can be used in combination with shorter length
5 banknotes. The banknotes can be aligned by leading or trailing edges or any other form of alignment such that the stack of banknotes on the accumulator defines the necessary gap. The actual length of a received banknote can be known from the validator which has conducted an evaluation of the
10 banknote.

The validator and dispensing unit of figures 2 and 3 has been shown with two accumulators 28 and 30. However, additional accumulators can also be provided.
15 Similarly the drive transport arrangement 24 is shown as a belt drive but other drive arrangements including rotational rollers are also possible. The validator has been described with respect to electronic circuitry for maintaining in memory different information as well as
20 coordinating the speeds of the transport 24 and the stacking and dispensing unit 26. Such electronic controls and memory are shown as 21 in Figure 3.

The embodiment of figures 7 and 8 illustrate a
25 pivoting one belt arrangement for stacking of banknotes on the accumulator and the dispensing of the stacked banknotes through the discharge port. The modified banknote stacker 100 of figure 8 is positioned for receiving a banknote and winding the banknote about the accumulator 102. The
30 accumulator is driven by belt 104 which also serves to trap stacked banknotes between the belt and the accumulator. The belt 104 is trained around end rollers 106 and 108 which are held in a fixed relative orientation by the V shaped arm member 110. This arrangement is pivotable about
35 shaft 112. Banknotes are stacked on the accumulator in manner similar to the stacker of Figures 4 and 5.

The motor 120 controls the position of the V arm arrangement and moves the rollers 106 and 108 to the discharge position shown in Figure 7. This motor has also caused movement of the discharge guide 122 to rotate
5 counter clockwise to align with the discharge port 124. This action also brings fingers 126 of the discharge guide into the slots provided on the accumulator. Motor 130 is reversed in direction and drives the belt 104 to cause a clockwise rotation of the accumulator. The stacked
10 banknotes 140 are dispensed as a stack after stripping from the accumulator.

The rotary stacker is easily controlled to form a stack of banknotes on the rotary accumulator which can be
15 stripped and dispensed as a stack through a discharge port. The stacker is fast and reliable and is easily coordinated with other devices such as temporary banknote accumulators.

Although various preferred embodiments of the
20 present invention have been described herein in detail, it will be appreciated by those skilled in the art, that variations may be made thereto without departing from the spirit of the invention or the scope of the appended claims.

25

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A device for receiving banknotes and dispensing received banknotes in stacked pack comprising a rotary accumulator of a size such that the banknotes to be dispensed can only be partially wrapped about said accumulator, said device including a first drive belt and a second drive belt with each drive belt in contact with a limited portion of said accumulator to define a banknote entrance in a gap between said drive belts and a banknote discharge slot in a gap between said drive belts, said accumulator being driven by said belts and said banknotes being located between said drive belts and said accumulator, and a control arrangement controlling the feed of banknotes about to be individually partially trained about said accumulator to stack banknotes on said accumulator one atop the other and in a manner to define a gap between leading and trailing ends of said stacked banknotes, said control arrangement including a gate member associated with said discharge slot and movable into said gap between said leading and trailing ends and stripping said stacked banknotes from said accumulator and discharging said stacked banknotes through said discharge slot.
2. A device as claimed in claim 1 wherein at least one of said drive belts drives said stacked banknotes through said discharge slot.
3. A device as claimed in claim 2 wherein said accumulator is driven in one rotational direction by said drive belts for accumulating stacked banknotes and said accumulator is driven in a second rotational direction for discharging stacked banknotes.
4. A device as claimed in claim 3 wherein said drive belts are located on opposite sides of said accumulator.

5. A device as claimed in claim 4 wherein said drive belts are each driven at the same speed.
6. A device as claimed in claim 4 wherein said control arrangement compares a signal from a separate drive feeding a banknote to be stacked to said device that includes information with respect to the position of the banknote with a signal from said device that includes information with respect to the position of stacked banknotes on said accumulator and adjusts the speed of said stacked banknotes relative to said banknote being feed to stack the feed banknote atop the banknotes already stacked on said accumulator.
7. A device as claimed in claim 6 wherein leading or trailing edges of banknotes are aligned in the banknotes stacked on said accumulator.
8. A device as claimed in claim 7 wherein said accumulator is freely rotatable and driven by said drive belts for stacking of banknotes.
9. A device as claimed in claim 8 wherein said device includes guide members in said entrance slot for guiding the leading edge of stacked banknotes between a discharge of said second drive and an engage point of said first drive.
10. A device as claimed in claim 1 wherein during stacking of banknotes said accumulator is being driven by said drive belts as a banknote to be added to said stack is feed to and received by said device.
11. A method for receiving banknotes and dispensing received banknotes in stacked pack comprising receiving individual banknotes and aligning each received banknote with a known position on a rotary accumulator to form a

stack of banknotes covering only part of said accumulator, and discharging said stacked banknotes through a discharge slot by stripping of said stacked banknotes from said accumulator and guiding said stacked banknotes as a stack through the discharge slot.

12. A method for receiving banknotes and dispensing received banknotes in stacked pack comprising receiving individual banknotes and accumulating and aligning each received banknote with other received banknotes to form a stack of banknotes, and discharging said stack of banknotes through a discharge slot by engaging said stack of banknotes driving said stack of banknotes through a discharge slot.

13. A method as claimed in claim 11 wherein the step of accumulating and aligning received banknotes includes aligning each received banknote with a known position on a rotary accumulator to form a stack of banknotes covering only part of said accumulator, and said step of discharging said banknotes includes stripping of said stacked banknotes from said accumulator and guiding said stacked banknotes through the discharge slot.

14. A device for dispensing a stack of banknotes comprising a rotary accumulator for receiving banknotes and training of the received banknotes on the accumulator with a portion of the accumulator exposed between ends of the banknote, a drive belt arrangement partially trained about said accumulator for driving the accumulator in sympathy with the drive belt arrangement in a first direction for stacking banknotes on said accumulator and in a second direction for dispensing stacked banknotes, a control arrangement controlling the speed of said drive belt arrangement in said first direction relative to a fed speed and position of a banknote to be stacked to align the fed banknote atop previously stacked banknotes, and wherein said belt drive arrangement when rotated in said second

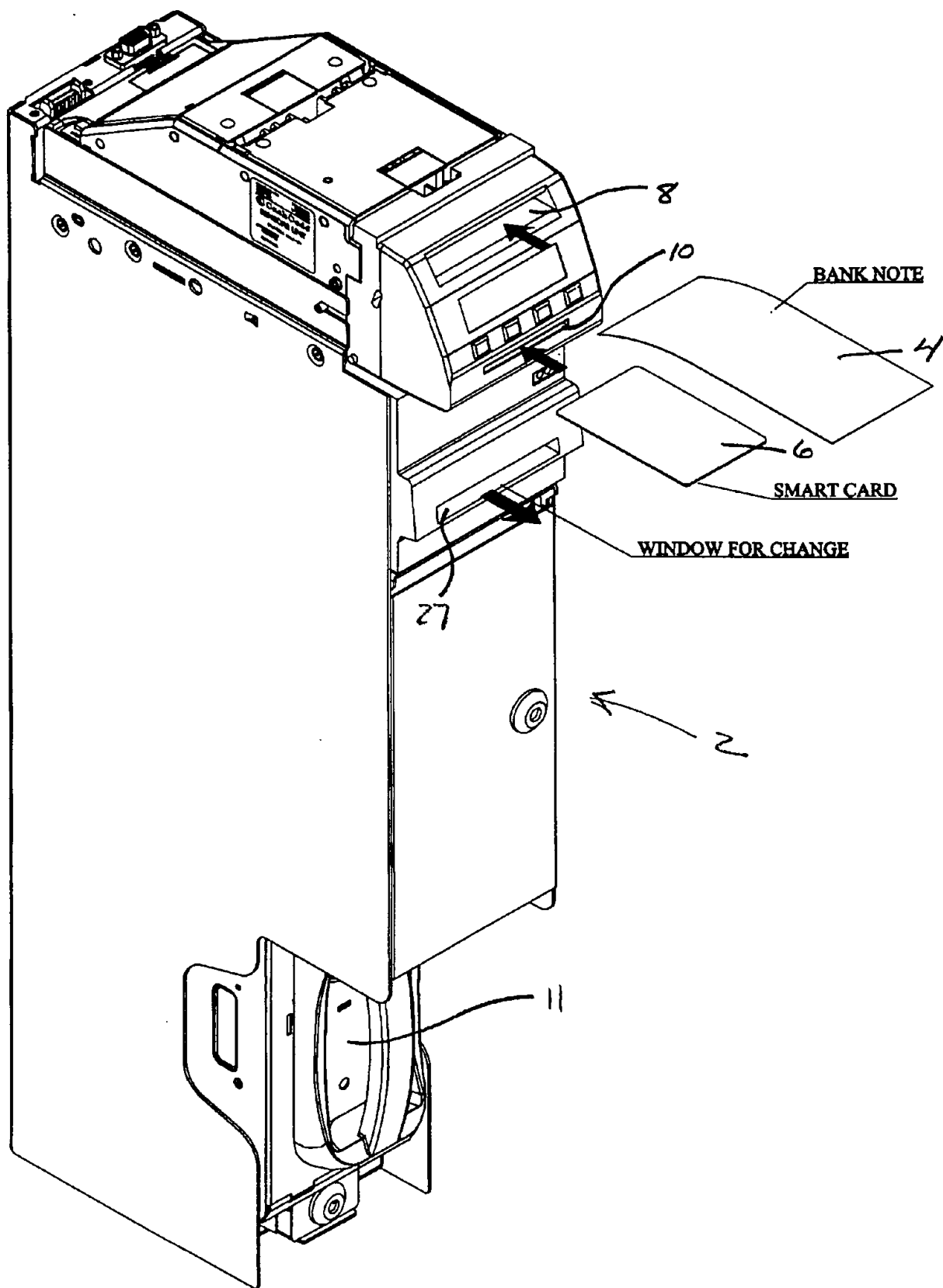
direction cooperates with a gate member associated with a discharge port, said gate member when said belt drive is driven in said second direction engaging said accumulator and stripping stacked banknotes from said accumulator and forcing the stacked banknotes through said discharge port.

15. A device as claimed in claim 14 wherein said belt drive arrangement drives said stacked banknotes through said discharge port.

16. A device as claimed in claim 15 wherein said drive arrangement is two belt drives.

17. A device as claimed in claim 15 wherein said drive arrangement is a single belt drive having a movable combination inlet and outlet for receiving or discharging a banknote.

18. A device as claimed in claim 16 wherein said two belt drives are driven at a common speed and by a single motor.



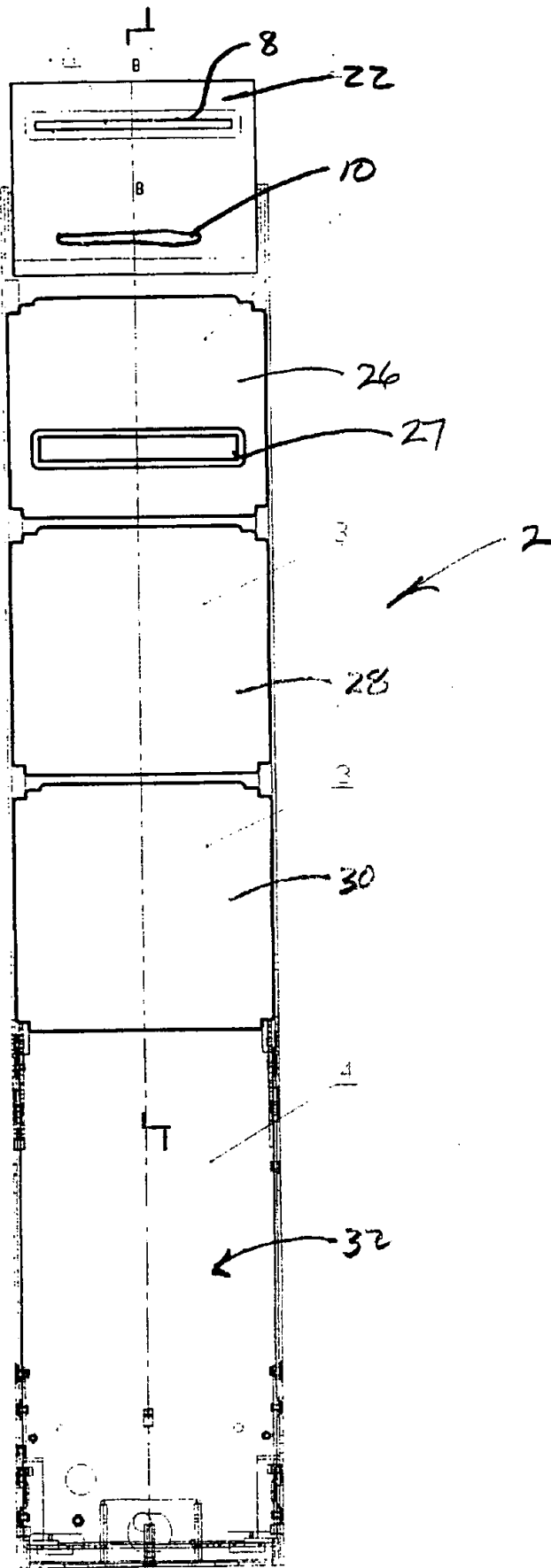
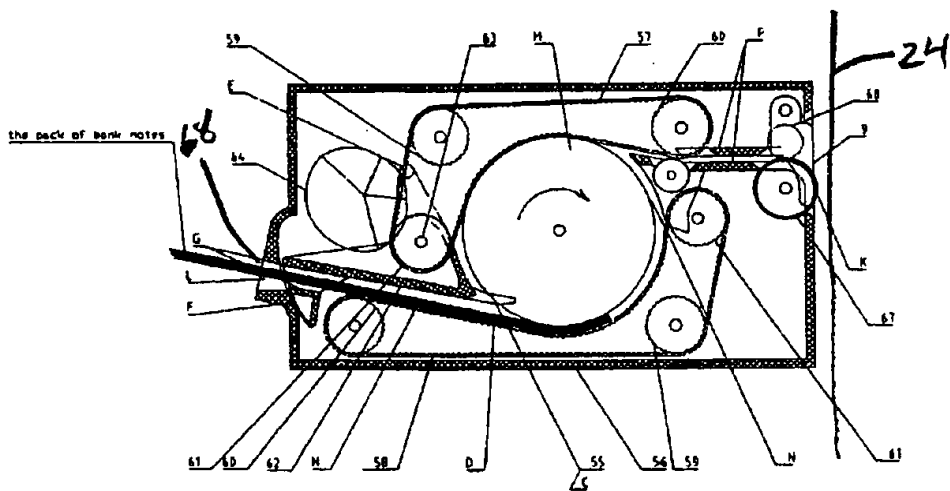
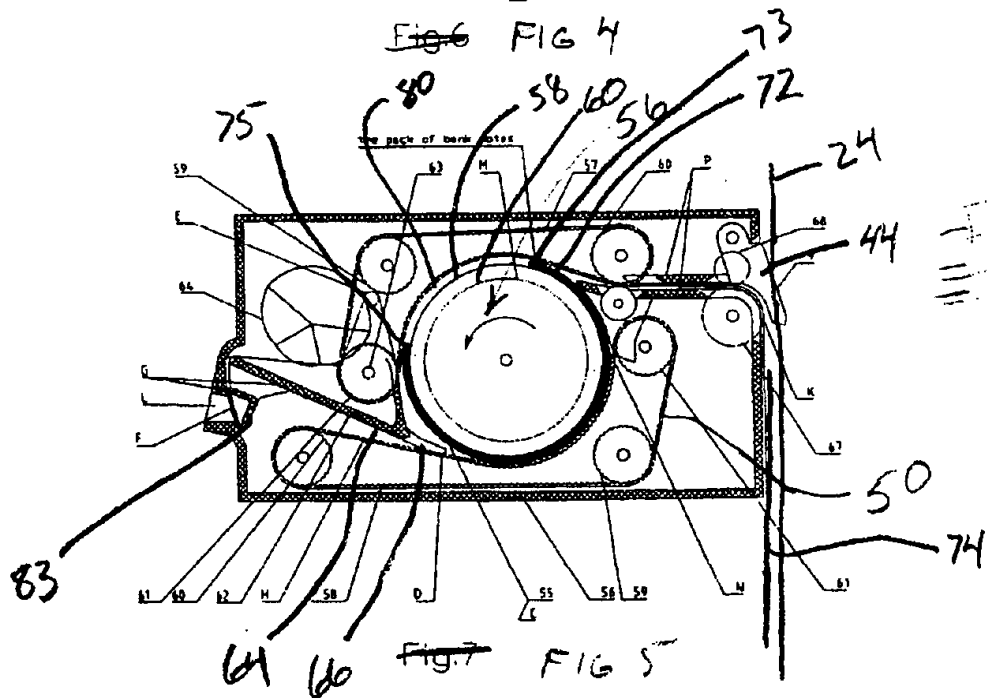
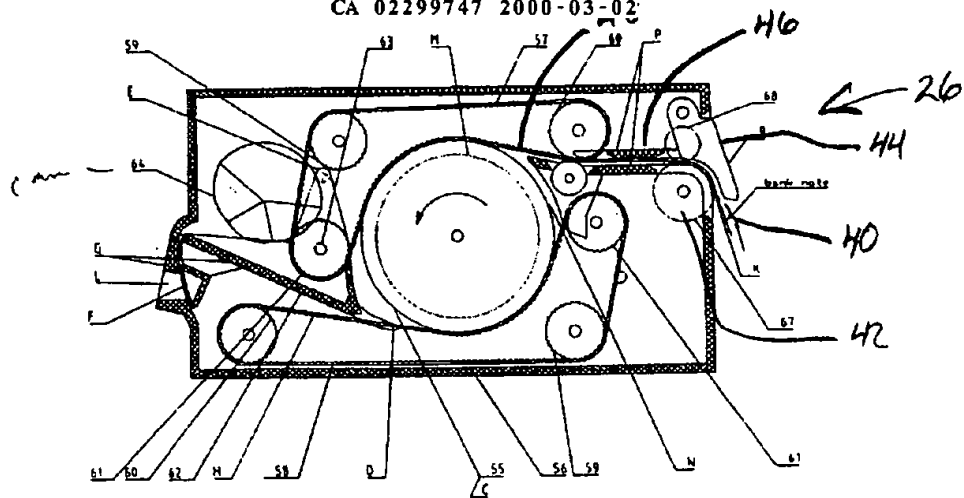
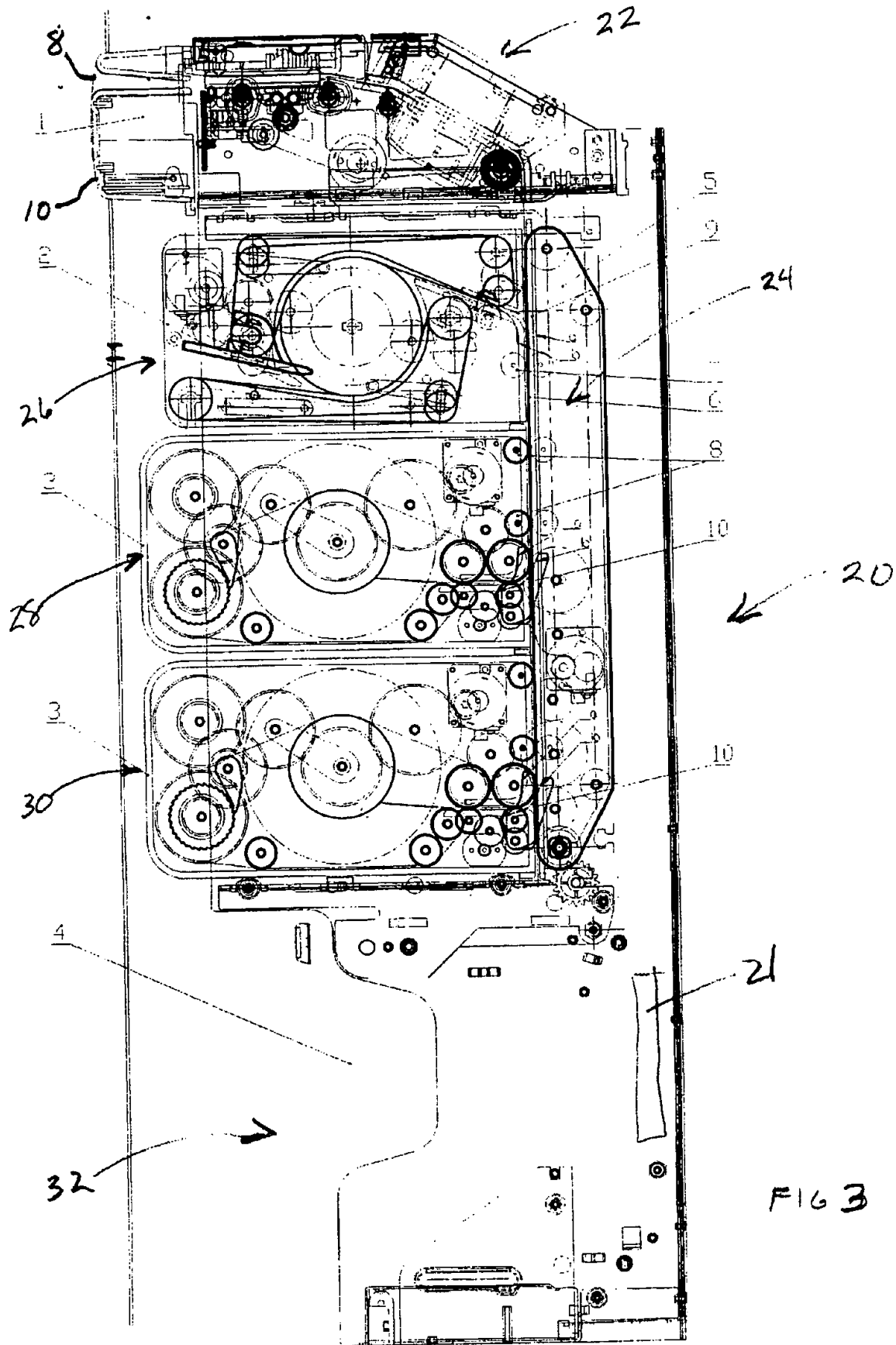
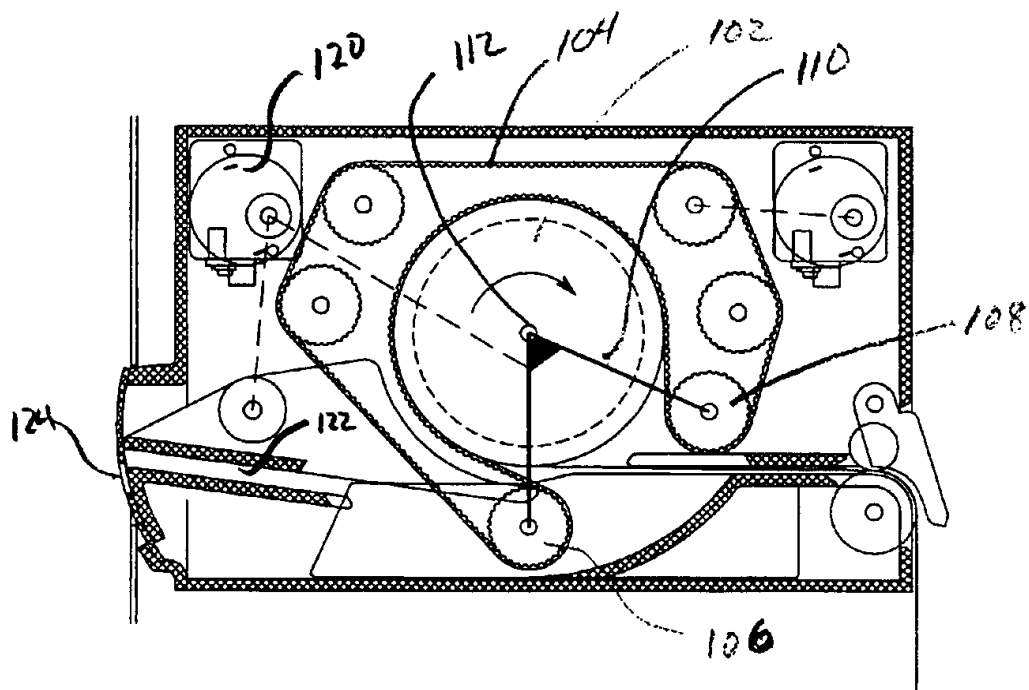
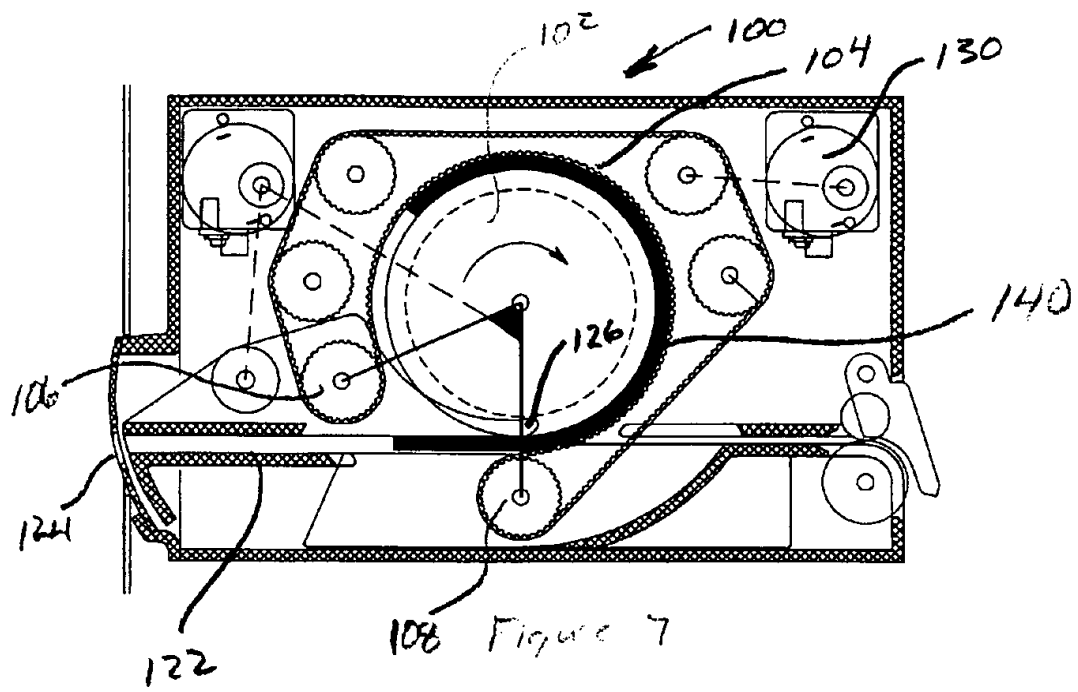


FIG 2



~~FIG 6~~ FIG 6.





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